S8	9	(((electric$2 or magnetic) adj2 field) same maxwell$3 adj3 equation) and (((716/1).CCLS.) ((703/2).CCLS.) ((703/13,14). CCLS.))	USPAT	OR	ON	2003/04/07 13:21
S9	13	((703/13,14).CCLS.) and (maxwell$3 adj3 equation)	USPAT	OR	ON	2003/04/07 13:27
S10	7	(((703/13,14).CCLS.) and (maxwell$3 adj3 equation)) not ((((electric$2 or magnetic) adj2 field) same maxwell$3 adj3 equation) and (((716/1).CCLS.) ((703/2).CCLS.) ((703/13,14). CCLS.)))	USPAT	OR	ON	2003/04/07 13:33
S11	17	meuris-p$4.in. or schoemaker-w$2.in. or magnus-w$2.in.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2005/07/18 12:26
S12	3	(("6064810") or ("6137492") or ("6266062")).PN.	USPAT; USOCR	OR	OFF	2003/04/08 07:48
S29	2	(("6665849") or ("6453275")).PN.	USPAT	OR	OFF	2005/03/26 11:50
S30	22	meuris-p$4.in. or schoemaker-w$2.in. or magnus-w$2.in.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/07/18 12:30
S31	1162	(716/1).CCLS.	US-PGPUB; USPAT	OR	OFF	2005/07/18 12:28
S32	1422	(703/2).CCLS.	US-PGPUB; USPAT	OR	OFF	2005/07/18 12:28
S33	1432	(703/13,14).CCLS.	US-PGPUB; USPAT	OR	OFF	2005/07/18 12:28
S34	2	(("6665849") or ("6453275")).PN.	USPAT	OR	OFF	2005/07/18 12:57
S35	6843	((maxwell$3 or field) near3 equation$2)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/07/18 12:58
S36	5071	((maxwell$3 or field) near3 equation$2) and (sing$6 or one?form)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/07/18 12:59
S37	664	((maxwell$3 or field) near3 equation$2) and (sing$6 or one?form) and (dummy or scalar)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/07/18 13:00

S38	48	((maxwell$3 or field) near3 equation$2) and (sing$6 or one?form) and (dummy or scalar) and ("703"/$.ccls. or "716"/$.ccls.)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/07/19 06:42
S39	48	((maxwell$3 or field) near3 equation$2) and (sing$6 or one?form) and (dummy or scalar) and ("703"/$.ccls. or "716"/$.ccls.)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/07/19 07:21
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Teaching electromagnetic field theory using differential f

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This paper appears in: **Education, IEEE Transactions on**
Publication Date: Feb. 1997
Volume: 40 , Issue: 1
On page(s): 53 - 68
ISSN: 0018-9359
CODEN: IEEDAB
INSPEC Accession Number:5509978
DOI: 10.1109/13.554670
Posted online: 2002-08-06 21:24:57.0

Abstract
The calculus of differential forms has significant advantages over traditional methods as a
electromagnetic (EM) **field** theory. First, films clarify the relationship between **field** intens
providing distinct mathematical and graphical representations for the two types of fields. :
Faraday's laws obtain graphical representations that are as intuitive as the representatio
Third, the vector Stokes theorem and the divergence theorem become special cases of a
that is easier for the student to remember, apply, and visualize than their vector formulati
computational simplifications result from the use of forms: derivatives are easier to emplc
coordinates, integration becomes more straightforward, and families of vector identities a
algebraic rules. In this paper, EM theory and the calculus of differential forms are develo
elementary, conceptually oriented point of view using simple examples and intuitive moti
that because of the power of the calculus of differential forms in conveying the fundamen
theory, it provides an attractive and viable alternative to the use of vector analysis in teac
field theory

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simplifications curvilinear coordinates differential forms divergence theorem
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representations intuitive motivations magnetostatics mathematical represent
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Author Keywords
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